III. *Observations on the changes the Ovum of the Frog undergoes during the formation of the Tadpole. By Sir* EVERARD HOME, *Bart. V. P. R. S.*

Read November 25, 1824.

IN the year 1822, I laid before the Society a series of observations on the progress of the formation of the chick in the egg of the pullet, illustrated by drawings from the pencil of Mr. BAUER, showing that in the ova of hot-blooded animals the first parts formed are the brain and spinal marrow. I have now brought forward a similar series on the progress of organization in the ova of cold-blooded animals, illustrated in the same manner by microscopical drawings made by the same hand.

By comparing together the first rudiments of organization in the ova of these very distinct classes of animals, I shall be able to prove that, in both, the same general principle is employed in the formation of the embryo.

This enquiry has its interest considerably encreased, by the ova not being composed of similar parts.

The ova of the frog, which have been selected for this investigation, are found to have no yelk. If we examine these ova in the ovaria in which they are formed, we find them to consist of small vesicles of a dark colour; when they enter the oviducts they enlarge in size, and acquire a gelatinous covering, which increases in quantity in their course along those tubes; but the ova can neither be said to have acquired

their full size, nor to have received their proportion of jelly, till they arrive at a cavity close to the termination of each oviduct, formed by a very considerable enlargement of those tubes, corresponding, in many respects to the cloaca in which the pullet's egg is retained till the shell becomes hard.

These large bags, in which the oviducts of the frog terminate, when distended with ova, put on an appearance so like the enlarged horns of the uterus of the quadruped when they are filled with young ones, that they have by some anatomists been called a double uterus. This, however, is an improper appellation.

When the ova are deposited in these reservoirs, they become completely formed, and in a state to be impregnated by the male influence, which is applied to them in the act of their expulsion. As they are pressed upon each other, by being confined in a small space, the gelatinous covering takes on an hexagonal figure, in the centre of which is the ovum.

The ova, when examined by a magnifying glass in a strong light, exhibit an appearance so similar to the molecule in the pullet's egg, as to be readily mistaken for it; but a more attentive inspection shows, that it is only a white portion in the ovum, seen through the covering of the vesicle. When the vesicle is punctured by the point of a needle, the contents are so fluid as readily to run out, leaving the strong transparent membranous bag lined with a fluid nigrum pigmentum, empty.

Immediately after impregnation there is no change in the appearance of the jelly, nor of the vesicle contained in it, in

this respect corresponding exactly with what happens to the pullet's egg. The first change that is produced towards the formation of an embryo is, the contents of the vesicle expand, its form changes from that of a sphere to an oval, and when cut through its contents are no longer fluid. In the act of coagulation, the central portion becomes of a lighter colour than that which surrounds it, swells out in the middle, and there is a distinct line by which the two portions are separated from one another: the central part, in its future changes, is converted into brain and spinal marrow, and after these organs have acquired a defined outline, the heart and other viscera are seen forming in the darker substance.

This does not exactly correspond with what takes place in the pullet's egg, that of the frog having no yelk. In the pullet's egg, the part within the inner circle of the molecule, when impregnated by the male, undergoes the necessary changes to form the brain and spinal marrow; the part within the outer circle forms the blood and its vessels; the supplies out of which the other organs are to be produced, are afterwards derived from the yelk.

The membrane that forms the vesicle which is destined to contain the embryo when it has become a tadpole, has a power of enlargement as the embryo increases in size, and then performs the office both of the shell and of the membrane that lines it in the pullet's egg, at the same time serving as a defence to protect it, and allow of the blood being aerated.

The nigrum pigmentum lining the vescicle can only answer some secondary purpose, since it is not met with in the aquatic salamander, whose mode of breeding very closely

resembles that of the frog. Upon reflecting that the frog's spawn is exposed to the scorching effect of the sun, and in places where there is no shelter, this nigrum pigmentum may be given to the eggs as a defence for the young during its growth, which cannot be required in those of the aquatic salamander, since they are separately inclosed within the twisted leaves of water plants, and screened from the full force of the sun's rays. The plant whose leaves the aquatic salamander most generally selects to lay its eggs upon is the Polygonum persicare.

EXPLANATION OF THE PLATES.

PLATE V.

Fig. 1. A female frog laid open, just ready to shed her spawn; natural size.

Fig. 2. The ovaria and oviducts; natural size.

Fig. 3. Ova of different sizes taken from the ovarium; magnified five diameters.

Fig. 4. Ova from the upper part of the oviduct; magnified five diameters.

Fig. 5. Ova from the dilated portion of oviduct; natural size. A B. Two ova that had been a few minutes in water, to show the expansion of jelly; magnified five diameters.

Fig. 6. An ovum from which the jelly is removed; magnified ten diameters.

Fig. 7. The same ovum opened, to show that the contents are fluid; when they are allowed to coagulate and dried upon glass, ramifications are formed as in coagulating blood; magnified ten diameters.

Fig. 8. Some ova after being immersed in water for fourteen days; natural size.

Fig. 9. One of them magnified five diameter.

Fig. 10. The same ovum magnified ten diameters.

Fig. 11. The same ovum opened; its contents still fluid, in which oil is found; magnified ten diameters.

Plate VI.

Fig. 1. Ova six hours after being spawned on water; natural size. A. one of these ova; magnified five diameters. B. The same ovum magnified ten diameters. C. Longitudinal section of the same ovum; its contents in a half coagulated state, and putting on an organized structure; magnified ten diameters.

The rest of the ova spawned at the same time were kept in water, to watch the progress of the formation of the tadpole.

One of these was not impregnated, consequently remained unchanged, while the others became gradually more and more organized. This abortive ovum is placed at the top of each cluster with a mark *

Fig. 2. The cluster of ova 12 hours after being spawned, diminished by that examined in fig. 1.; of the natural size. A. One magnified five diameters. B. The same magnified ten diameters. C. The same, forming a longitudinal section; magnified ten diameters.

Fig. 3. Twenty-four hours after being spawned.

Fig. 4, Thirty-six hours after being spawned. At this period the ovum has its form considerably changed, and the head and tail of the tadpole are distinctly seen.

Fig. 5. Three days after being spawned. At this period muscular motion is for the first time perceptible. The letter D shows the ovum laid open on one side; magnified ten times, as in letter C.

Fig. 6. Four days after being spawned. The letters correspond to these in Fig. 5.

PLATE VII.

Fig. 1. Five days after being spawned. At this period the ova become separated, and the tadpoles begin to leave the ovum. A. Shows a tadpole in the act of extricating itself; magnified five diameters.

B. A back view of it; magnified eight diameters.

C. A belly view.

D. A side view.

E. A longitudinal section; all the views magnified eight diameters.

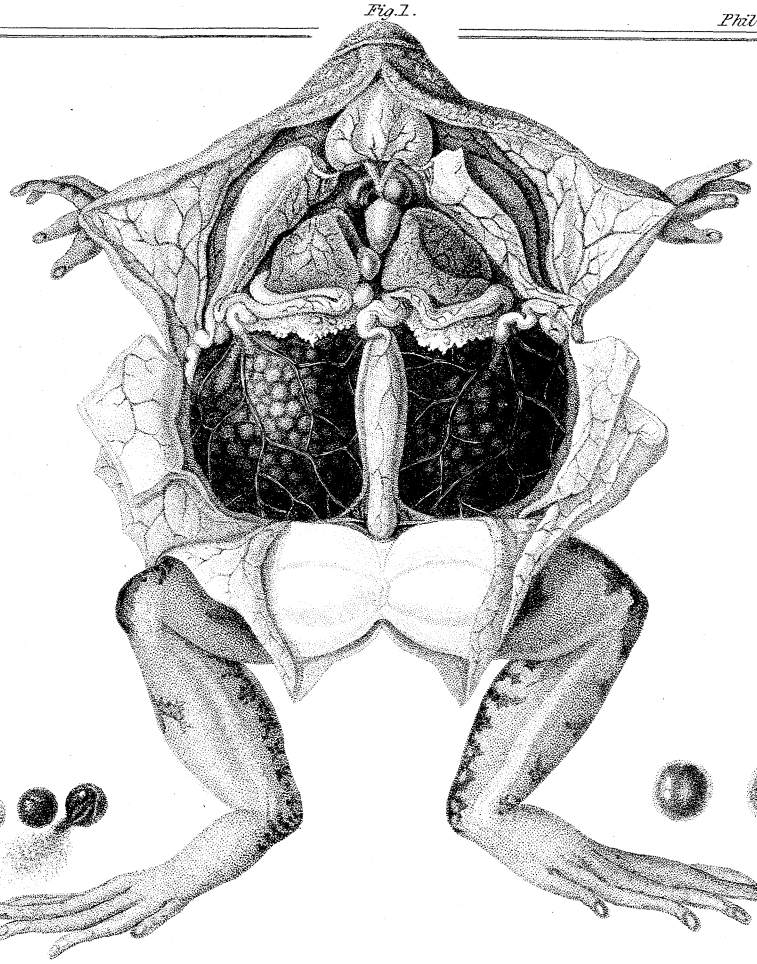
Fig. 2. Six days after being spawned, four different views; magnified eight diameters, as in Fig. 1.

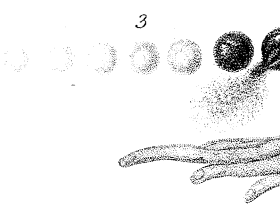
Fig. 3. Eight days after being spawned; all the views magnified eight diameters.

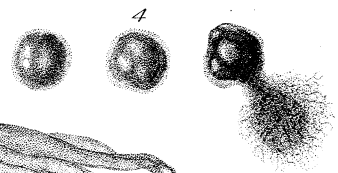
Fig. 4. Twelve days after being spawned; four views of the tadpole; magnified eight diameters.

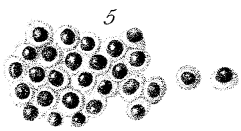
The animal in twelve days had become so far advanced in its growth to make further progress in the investigation unnecessary, after the splendid figures that are before the public upon that subject in different publications.

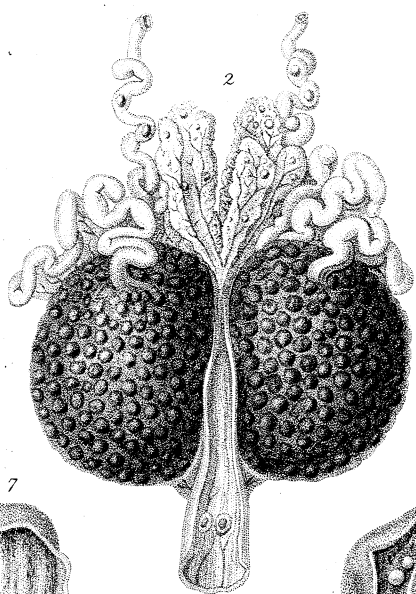
Fig. 1.

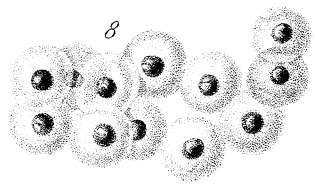


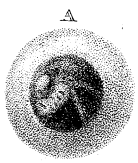


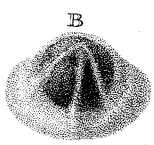


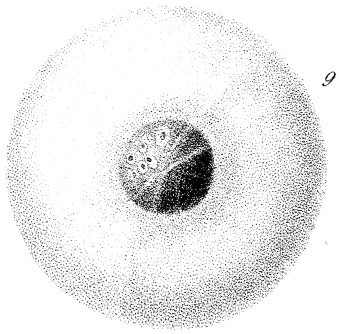


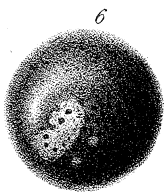


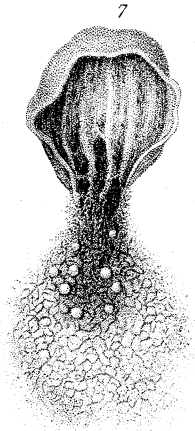


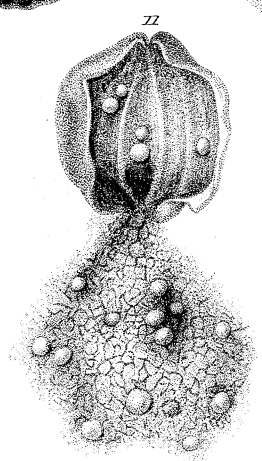


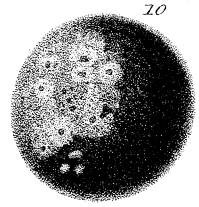












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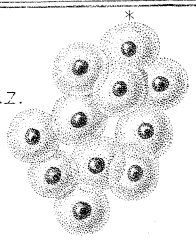

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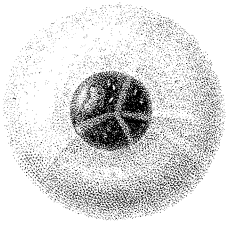

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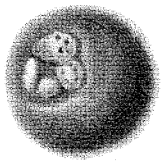

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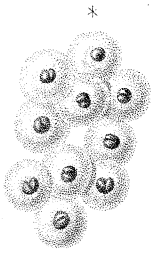

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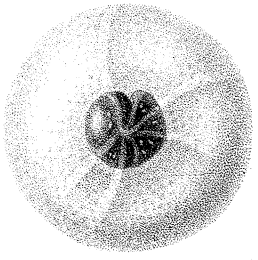

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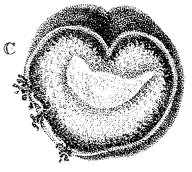

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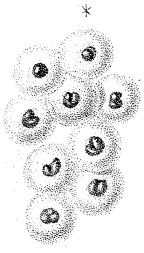

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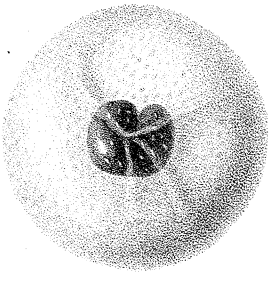

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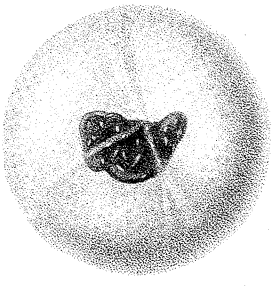

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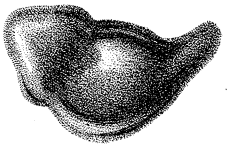

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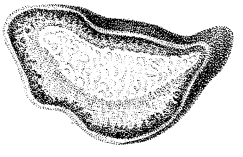

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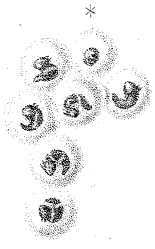

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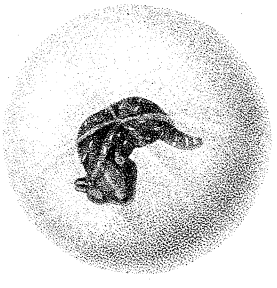

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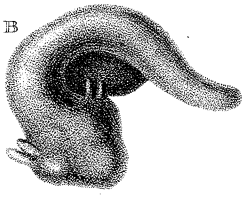

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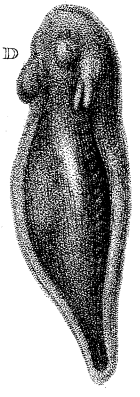

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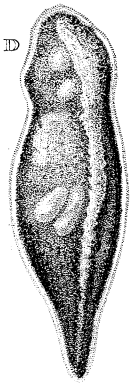

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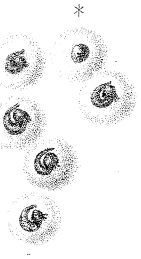

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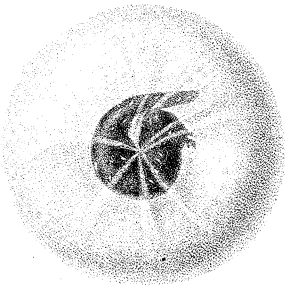

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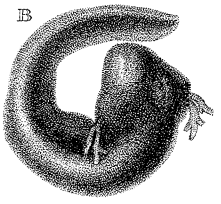

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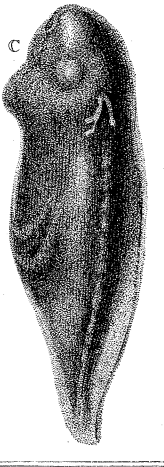

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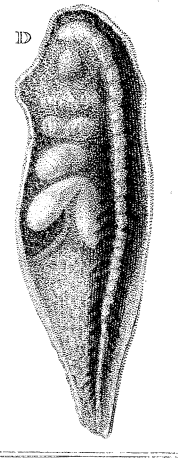

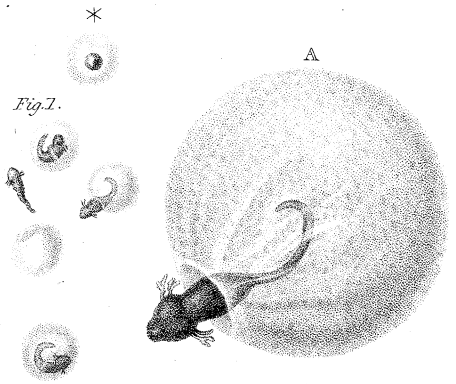

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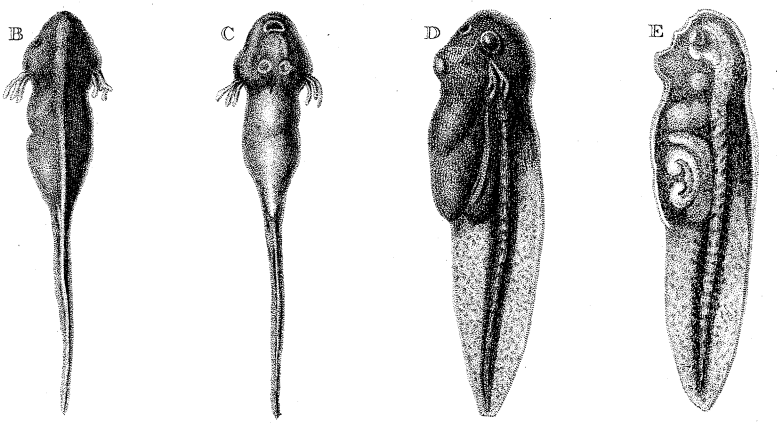

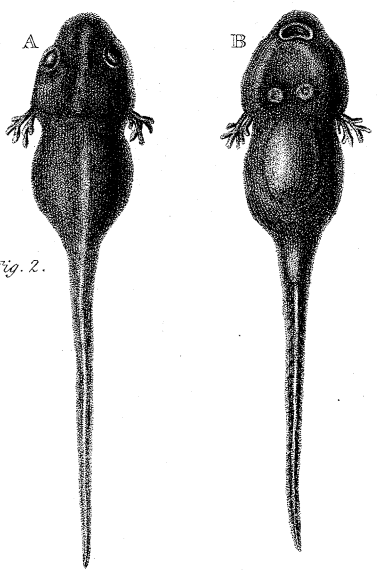

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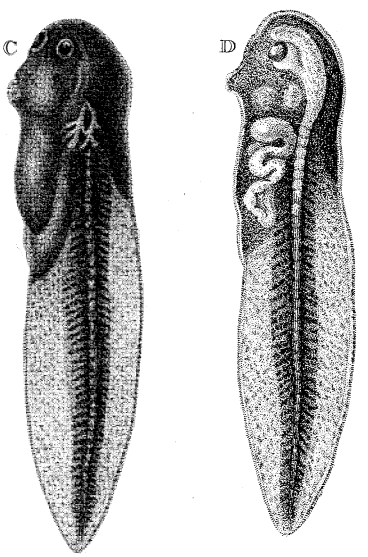

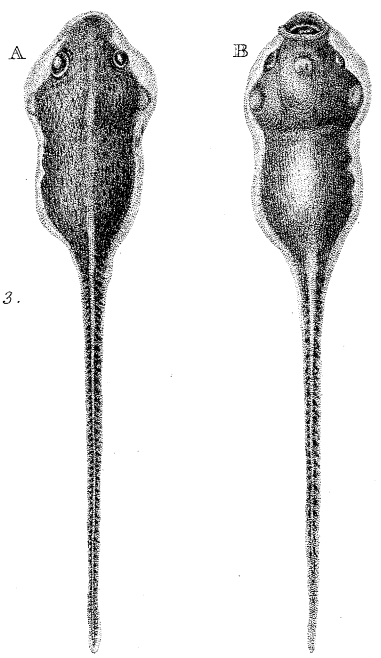

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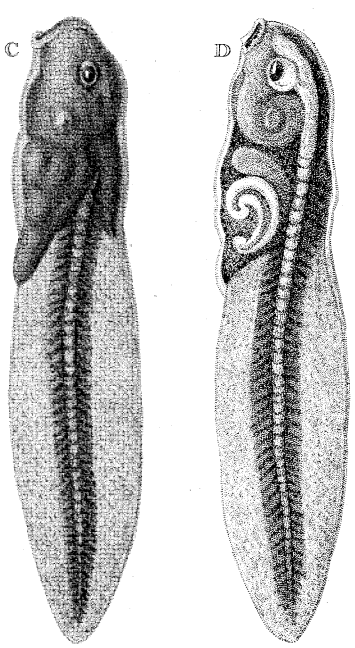

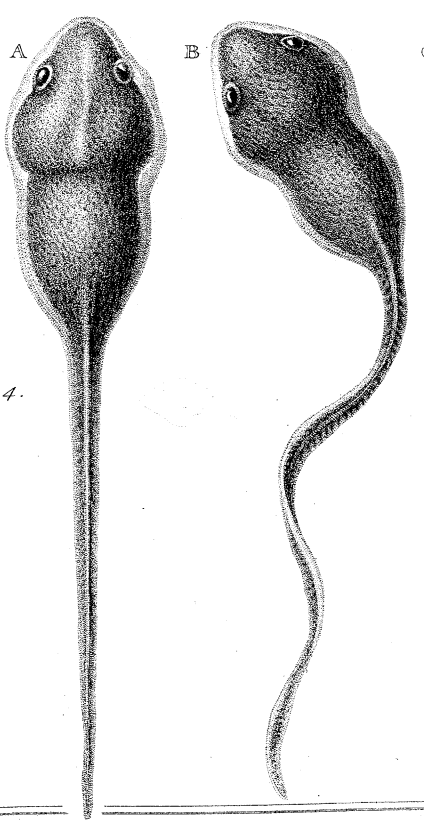

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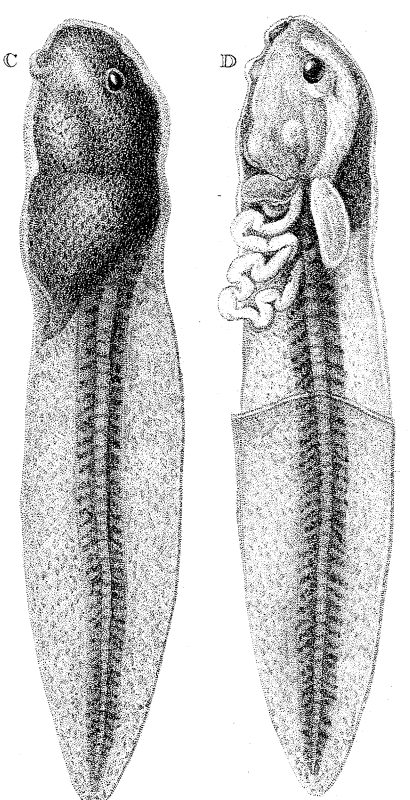

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